

# New Species of Macrolepidoptera and a Mimicry Complex from Fiji

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## Summary

Eight new species of macrolepidoptera from Fiji are described. A hypothesis is put forward to account for polymorphism in the four species of Lymantriidae found in Fiji.

In June, September and December 1968, H. S. Robinson and I revisited Nandarivatu, a locality in the north of Vitu Levu, Fiji. We operated two MV light traps for a total of thirteen nights and collected some 300,000 lepidoptera. One light trap was operated at the Forestry Department rest-house in the village of Nandarivatu on the boundary between primary montane rain forest and conifer plantations at a height of 850m. above sea level. In a previous paper (Robinson, 1968) this height was erroneously given as 1100m. The other light trap was operated at one of the two nearby hilltop radio stations, Koro-O and South Ridge, at just under 1000m. above sea level. A number of new species were collected of which seven are described below. Two of these also occur in lowland rain forest and an eighth appears to be restricted to lowland forest.

The fauna of the Fijian montane rain forest appears to contain a number of undescribed endemic elements which have no close allies or representatives in the island chain of the Solomons and New Hebrides linking Fiji to New Guinea, the home of the closest allies to these montane endemics. This is not surprising, however, as little collecting has been done in the montane forests of the New Hebrides and the Solomon Islands, and in all probability there is a vast montane fauna awaiting discovery on these islands.

All type material and genitalia preparations of the species described below have been deposited in the British Museum (Natural History), hereafter referred to as B.M.(N.H.).

### *Prospalta caerulea* sp. n. (Noctuidae, Acrionictinae)

Female: Head, thorax and abdomen greyish-brown, paler beneath; abdomen marked ventrally with a pair of black spots on each segment. Legs grey-brown speckled with rufous scales. Forewing grey-brown, irrorated and speckled with red-brown and black particularly around the reniform. Costa marked medially with five distinct black spots. Orbicular blue-grey edged with black, conspicuous. Reniform large, conspicuous, elongated, orange-brown fringed with white, open anteriorly. Postmedial line black, narrow, becoming obsolete on joining the distal margin of the reniform. Forewing apex pale orange-brown; terminal fascia blue-grey, brown towards the inner margin. Termen fringed with brown. Hindwing grey-brown. Holotype wingspan 37mm.

Male: Similarly patterned to the female; the paratype is worn and somewhat faded.

Diagnosis: The closest apparent ally of this species is *Prospalta incertissima* Bethune-Baker **comb. n.** (*Nov. Zool.*, **13**: 209) from Malaya, Sumatra, Borneo and New Guinea. *Caerulea* lacks the small and com-

pact reniform and triangular green basal patch of *incertissima*. *Incertissima* has blue-grey markings only at the forewing apex and lacks the distinct straight postmedial of *caerulea*. The male genitalia differ markedly: in *caerulea* the valves are expanded distally; in *incertissima* they taper. *Caerulea* possesses a long process arising midway along the length of the valve, absent in *incertissima*.

Distribution: Known only from rain forest on Viti Levu—extremely rare.

Holotype: ♀, Fiji, Savura Creek (near Suva), 1966/67 (H. S. Robinson), in B.M.(N.H.).

Paratypes: ♂, Fiji, 1966/67 (H. S. Robinson), in B.M.(N.H.). 2 ♀♀, Fiji, Nandarivatu, 27-30.ix.1968 (H. S. and G. S. Robinson), in B.M.(N.H.).

### ***Giaura sokotokai* sp. n. (*Sarrothripinae*)**

Male: Head and thorax grey above, speckled with black and rufous; abdomen brownish grey above, silver-grey beneath. Underside of head and thorax silver-grey. Legs silver-grey below, rufous above. Forewings steel-grey speckled with black and rufous, basally rufous-purple. Terminal fascia rufous, fringes grey. Subterminal line black, serrate, edged outwardly with grey. Dark rufous-purple medial and postmedial transverse bands obscured towards the middle of the wing by rufous and grey clouding which extends to the posterior margin, indistinct. Hindwing silvery-white clouded with grey at the termen, fringed with white. Paratypes exhibit some variability of marking, especially in the edging of the transverse bands with lines of deep rufous or black scales. Wingspan of holotype 24 mm.

Female: Similar to the male.

Diagnosis: The closest apparent allies of this species are *Giaura tetragramma* Hampson (*Ann. Mag. nat. Hist.* (7) 16: 549, 1905) from Fiji and the Solomon Islands and *Giaura rebeli* Tams **comb. n.** (*Ins. Samoa* 3, fasc. 4: 208, 1935) from Samoa. Close examination and comparison of *tetragramma*, *rebeli* and *sokotokai* indicates their close affinity; therefore I remove *rebeli* from its original generic placing in *Barasa* and place it in the genus *Giaura*. In *sokotokai* the subterminal line is serrate: in *tetragramma* the line is straight: in *rebeli* it is intermittent but practically straight. *Rebeli* is smaller and paler than *sokotokai*. *Sokotokai* and *tetragramma* which fly together may also be differentiated by examination of the male genitalia. The long and uniformly narrow processes from the valves of *tetragramma* are expanded and flattened at the tip in *sokotokai*. The tip of the process bears a line of very small and fine black spines in both species but in *sokotokai* this is lengthened and widened so as to be easily visible to the naked eye in a preparation.

Distribution: Known only from the type locality.

Holotype: ♂, Fiji, Nandarivatu, 27-30.vi.1968 (H. S. & G. S. Robinson), in B.M.(N.H.).

Paratypes: 2 ♂♂, 2 ♀♀, data identical to that of holotype, in B.M.(N.H.).

This species is named after Mr Esira Sokotoka, Posts & Telegraph Department Supervisor at Nandarivatu to whom H. S. Robinson and I are indebted for his generous assistance in operating light traps at Koro-O and South Ridge.

**Anua fijiensis** sp. n. (*Noctuidae*, *Catocalinae*)

Male; Head, thorax and abdomen yellow above, brownish-yellow below; coxae and femorae yellowish brown, tibiae and tarsi blackish brown. Forewing lemon-yellow with a greenish tinge, darker basally. Terminal fascia reddish-brown, an oval grey-brown patch at the base fringed with black; two conspicuous black marks on the subterminal boundary towards the costa; two faint postmedial lines of purple-brown dots. Reniform black fringed with purple-brown, ringed with black, conspicuous. Orbicular a small purple-brown dot. Hindwing uniformly bright yellow. Wingspan of holotype 74mm.

Female: Similar to the male.

Diagnosis: This species bears a superficial resemblance to *Anua kenricki* Bethune-Baker (*Nov. Zool.* 13: 259, 1906) from Ceram, Buru and New Guinea. *Kenricki* lacks the black spots on the subterminal boundary and the reniform is much paler than in *fijiensis*. The orbicular stigma is circular in *kenricki*, a dot in *fijiensis*. The hindwing of *kenricki* is paler than that of *fijiensis* and the greenish tinge of the *fijiensis* forewing is absent. *Kenricki* usually has a brown patch in the posterior of the medial fascia adjacent to the subterminal boundary and this is absent in *fijiensis*.

Distribution: Known only from the primary montane rain forest around Nandarivatu, over 900m. above sea-level—fairly common.

Holotype: ♂, Fiji, Nandarivatu, 27-30.vi.1968, (H. S. & G. S. Robinson), in B.M.(N.H.).

Paratypes: 2 ♂♂, data identical to that of holotype, in B.M.(N.H.).

**Parallelia koroensis** sp. n. (*Noctuidae*, *Catocalinae*)

Male: Abdomen grey-brown; palps, head, thorax, femora and tibiae red-brown, tarsi black-brown. Antennae black-brown, basally white on the upper surface; palps tipped with white. Forewing purple-brown, a subterminal black dot on each vein; postmedial band brown, darkening inwardly. Inner line brown, enclosing a mauve-brown medial band. Termen diffusely speckled with mauve. A faint white line bounds the apical patch. Hindwing grey-brown speckled with mauve at the termen, a small black subterminal dot on each vein, ringed with mauve. Wingspan of male holotype: 57mm.

Male genitalia: Valves small, bearing a large trifurcate claw-like clasper at the base; uncus simple, elongated; juxta with two long chitinous projections.

Female: Similar to male.

Diagnosis: The closest apparent ally of this species is *Parallelia mediifascia* Wileman & South (*Entomologist*: 53, p. 273, 1920) from the Philippines, from which it differs markedly. In *mediifascia* the forewing apex is acute, the outer line is erratic but distinct and the postmedial band is bluish. In *koroensis* the forewing apex is blunt, the postmedial straight but indistinct at the base of the wing and the postmedial band is dark brown. The hindwing termen in *mediifascia* is white whereas in *koroensis* it is speckled with mauve, the mauve concentrated into rings around the subterminal dots.

Distribution: Known only from the primary montane rain forest around Nandarivatu, some 900m. above sea level.

Holotype: ♂ Koro-O (Nandarivatu, Fiji), 6.ix.1967, (H. S. Robinson). In B.M.(N.H.).

Paratypes: 2 ♂♂, Nandarivatu, 27-30.vi.1968, (H. S. & G. S. Robinson). In B.M.(N.H.).

**Diomea fenella sp. n.** (Noctuidae, Ophiderinae)

Male: Head, thorax, abdomen and legs deep purple-brown flecked with white, legs white at articulations. Fore- and hindwings deep purple-brown with two subterminal lines of crescentic white markings. Postmedial transverse line of white crescentic markings on both fore- and hindwings. Reniform dark, suffused. Conspicuous diffuse white fascia at base of forewing. Anal angle of hindwing with a conspicuous rectangular white mark flecked with purple. Wingspan of holotype 35mm.

Paratype: Appears to be a dark aberration, the white markings of the holotype replaced by deep red-brown.

Genitalia: Complex and remarkably modified; valve with two short slender processes, one large superior club-like process and one very long slender appendage. Flap-like distal portion of valve furnished with long hairs. Uncus simple. Aedeagus with a group of fine spines just below the hooked tip.

Female: Unknown.

Diagnosis: The closest apparent ally of this species is *Diomea rotundata* Walker (*List Lep. Ins. B.M.*, 13: 1110, 1857) from India and Ceylon to Formosa, the Philippines and New Guinea. All specimens of *rotundata* which I have seen are smaller than the holo- and paratype of *fenella* by at least 5mm. wingspan. *Fenella* lacks the white postmedial costal mark of *rotundata*; the reniform is diffuse and not a solid black mark as in *rotundata*. The genitalia differ markedly, *rotundata* lacking processes on the valves. The aedeagus of *rotundata* lacks a hooked tip and there are no cornuti or fine spines on the vesica.

Distribution: Known only from two specimens taken in Suva, Fiji.

Holotype: ♂, Fiji, Suva, May 1966, (H. S. Robinson), in B.M.(N.H.).

Paratype: ♂, Fiji, Suva, May 1966, (H. S. Robinson), in B.M.(N.H.).

**Mecodina variata sp. n.** (Noctuidae, Ophiderinae)

Male: Head, thorax and abdomen purple-brown, palps red-brown. Fore tibiae and tarsi red-brown, fore femur, mid- and hindlegs dark grey. Forewing dark purple-brown, darker medially, reniform and orbicular black. Postmedial line red-brown, indistinct, terminating in a black subapical patch and bowing inward to join a black crescent below the reniform, ending at the posterior margin. Subterminal line of black spots fringed with brown. Basal line deep purple-brown. Hindwing dark purple-brown, a large black crescentic mark in the anal angle, three postmedial black dots fringed outwardly with white, a line of minute subterminal spots.

Paratype male: Uniform purple-brown, forewing darker medially but unmarked except for cream orbicular. Hindwing crescent cream, hindwing dots as in the holotype.

Second paratype male: Greyish black with a cream submedial band in the forewing; postmedial line cream, obsolete towards posterior margin. Hindwing crescent and dots cream. Holotype wingspan 46mm.

Female: Similarly patterned to the first paratype male but paler and markedly more russet, especially at the base of the forewing and on the thorax. Hindwing crescent practically obsolete.

Diagnosis: The nearest apparent ally of this species is *Mecodina striata* Hampson (*Gen. Spec. Noct.*, p. 492, 1926) from New Guinea. The forewing apex of *striata* is right-angled: *variata* has a concave termen and acute apex. There are no subterminal spots on the hindwing of *striata*. In *striata* the boundary between the paler basal fascia and darker medial fascia runs through the reniform; in *variata* the boundary passes between reniform and orbicular. In *striata* the postmedial line is approximately parallel to the termen: in *variata* it bows sharply inwards posteriorly.

Distribution: Coast to 1000m. on Viti Levu, Fiji: rare in lowland forest but moderately frequent in montane rain forest.

Holotype: ♂, Fiji, South Ridge (Nandarivatu), 6.ix.1967, (H. S. Robinson), in B.M.(N.H.).

Paratypes: ♂, Fiji, 1966-67, (H. S. Robinson), in B.M.(N.H.). ♂, Fiji, Nandarivatu, 27-30.vi.1968, (H. S. & G. S. Robinson), in B.M.(N.H.). ♀, Fiji, 1966-67, (H. S. Robinson), in B.M.(N.H.).

#### ***Dasychira flavobrunnea* sp. n. (Lymantriidae)**

Male: Head and thorax brownish cream above, thorax paler below; abdomen mouse-grey. Palps and head black below. Antennae cream, pectinations brown. Legs cream, banded with black at articulations. Fore tibia with a black spot above and a black longitudinal streak below. Mid- and hind tibiae with the black spot only. Forewing brownish yellow, postmedial band narrow, cream, edged with black distally, brown proximally. Reniform cream ringed with brown, obliquely elongate. Medial fascia cream, narrowing and shaded with brown posteriorly, bounded inwardly by a brown serrate line. Basal to this line a white transverse band edged by a black dentate line bounding a basal fascia of brownish yellow fading to white at the costa and base. Basal line fine, black, serrate. Terminal fascia brownish yellow, veins black, terminal line of black scales, fringe of brownish yellow scales. Subterminal line of crescentic black spots 1mm. from termen, diverging further posteriorly. In two of the paratypes the terminal and basal fasciae heavily marked with black; base of forewing still white. Hindwing uniform dark grey, fringes paler. Wingspan of holotype 38mm.

Female: Unknown.

Diagnosis: Closely related to *Dasychira nandarivatu* Robinson (*Ent. Record* 80: 253) but the dark hindwing and overall yellowness of the forewing makes *flavobrunnea* distinct. The subterminal line of crescentic black spots is further removed from the termen in *flavobrunnea* than in *nandarivatu*. The genitalia of the two species are similar but the claspers of *flavobrunnea* are longer and more curved than those of *nandarivatu*. The aedeagus of *flavobrunnea* bears two groups of many fine thorn-like cornuti, absent in *nandarivatu*.

Distribution: Known only from the type locality.

Holotype: ♂, Fiji, Nandarivatu, 16-20.xii.1968, (H. S. & G. S. Robinson), in B.M.(N.H.).

Paratypes: 3♂♂, data identical with that of holotype, in B.M.(N.H.). ♂, Fiji, Nandarivatu, 27-30.ix.1968, (H. S. & G. S. Robinson) in B.M.(N.H.).

**Euproctis mimetica** sp. n. (*Lymantriidae*)

Male: Head, thorax and abdomen ochreous, palps and underside of head black. Legs ochreous, banded with black on the upperside at articulations; upperside of tibiae with a black spot in the middle. Antennae ochreous speckled with black, pectinations streaked with brown. Forewing ochreous yellow speckled with brown scales. A wide brownish-black stripe extends from the posterior margin of the wing, bowing outward and terminating 4 mm. from the costa. Two black spots on the inner margin of the black stripe at the distal margin of the cell; two faint brown subterminal spots slightly distal to the outer boundary of the stripe. Termen marked with small blackish-brown dots. Hindwing dark grey-brown, paler distally. Holotype wingspan 41 mm. The paratype caught in June 1968 lacks the black stripe and is not as yellowish as the other specimens; however its genitalia are identical to those of the holotype. Forewing ochreous, marked only with the two black dots at the distal end of the cell, two faint brown subterminal spots and a faint basal line of brown scales enclosing a paler basal fascia. A faint postmedial brown spot towards the posterior margin. Hindwing more brownish than the holotype.

Female: Unknown.

Diagnosis: This species has no apparent allies; the black stripe alone serves to distinguish it from all known *Euproctis* species.

Distribution: Known only from the type locality.

Holotype: ♂, Fiji, Nandarivatu, 27-30.ix.1968, (H. S. & G. S. Robinson), in B.M.(N.H.).

Paratypes: 2 ♂♂, data identical with that of the holotype, in B.M.(N.H.). ♂, Fiji, Nandarivatu, 27-30.vi.1968, (H. S. & G. S. Robinson), in B.M.(N.H.).

With the description of this species the total number of Lymantriid species recorded from Fiji is four. There are the three *Dasychira*, *fidjiensis* Mabille & Vuillot, *nandarivatu* Robinson and *flavobrunnea* sp. n. forming a compact tripartite group and *Euproctis mimetica*. I described (1969) the wing pattern variation of male *D. fidjiensis* and from the original descriptions it will be seen that in *D. flavobrunnea* and *E. mimetica* (above) and *D. nandarivatu* (Robinson, 1968) the males are also polymorphic. Several female *D. nandarivatu* have been obtained recently and, as in *D. fidjiensis*, are larger than the males and lack variation in the wing pattern.

The common feature of polymorphism in male Fijian Lymantriids is the presence or absence of dark brown or black transverse bands on the forewing; I can find no other examples of Lymantriid species which exhibit this type of variation. Thus I believe that significance must be attached to this common polymorphic state.

In the case of the three *Dasychira* species, polymorphism might be considered to be apostatic (see Clarke, 1962), an adaptation to prevent a predator "getting its eye in" or, as Tinbergen puts it, developing "specific searching images". Apostatic polymorphism is not rare but the probability of it taking a practically identical form independently in these three species is remote: therefore it might be thought to be an inheritance from a common ancestor which possessed this type of apostatic

polymorphism. *D. nandarivatu* and *D. flavobrunnea* appear to be very closely related indeed, *D. fidjiensis* being a rather more distant cousin. Unfortunately these three species appear to have no close allies so no further indication of inherited polymorphism can be obtained. However, Clarke suggests that apostatic polymorphism enhances the probability of sympatric speciation with the divergence of the two or more polymorphic forms and speciation would involve the destruction of the polymorphic state. Thus it appears that the theory of inheritance of apostatic polymorphism is untenable.

The presence of a comparably polymorphic *Euproctis* species (again, a most unusual phenomenon) suggests that some sort of mimicry complex might be involved and mimicry must be Batesian for polymorphism to occur.

*D. nandarivatu*, *D. flavobrunnea* and *E. mimetica* are known only from primary montane rain forest on the island of Viti Levu. No specimens of these species have been taken at heights of under 850m., therefore the complex must only operate in the collective habitat of primary montane rain forest. In this zone *D. fidjiensis* is common, *D. nandarivatu* fairly frequent and *D. flavobrunnea* and *E. mimetica* extremely rare. *D. fidjiensis* is a successful and widespread species, occurring commonly from the coast to at least 1000 m. on Viti Levu and on at least two other islands as well. *D. nandarivatu* is restricted but successful and the other two species are plainly not successful. *D. fidjiensis* appears to be avoided by the fowls and mynah birds which scavenge around light traps and is probably distasteful. As such, it is the prime candidate for model. Being at least mildly distasteful and fairly uncommon compared with other species of lepidoptera it also fulfils what Clarke states to be the most favourable requirements for apostatic polymorphism to evolve.

Assuming *D. nandarivatu*, *D. flavobrunnea* and *E. mimetica* to be palatable there is a selective advantage in their mimicking *D. fidjiensis* and thus they have evolved polymorphic patterns which mimic the two most striking morphs of *D. fidjiensis*. Increasing success of the mimics would result in increased predation of model and mimics and disruption of the mimicry complex would occur. Selection would perhaps then favour the evolution of further patterns in the model different from those of the mimics until predation of mimics or survival of the model rose to a sufficient level to stabilise the mimicry complex again. It is possible that this has happened: *D. fidjiensis* has a variety of patterns at its disposal but the most striking morphs are still the banded ones. From subjective evidence it appears that *D. fidjiensis* exhibits a greater variety of wing patterns in montane rain forest than in the lowlands. After his first visit to Nandarivatu in September 1967 H. S. Robinson noted (in an unpublished report) "very remarkable and beautiful variations of *D. fidjiensis*".

In this mimicry complex however, the situation does not appear to be a simple case of three palatable species mimicking one distasteful species. It is difficult, for example, to take *E. mimetica* to be a mimic of *D. fidjiensis*, the two morphs of each are so markedly dissimilar. However, *E. mimetica* could in all probability masquerade as *D. flavobrunnea* which in turn bears a very striking similarity to *D. nandarivatu*. Thus

I believe the scheme of mimicry to be as shown diagrammatically below in Fig. 1.

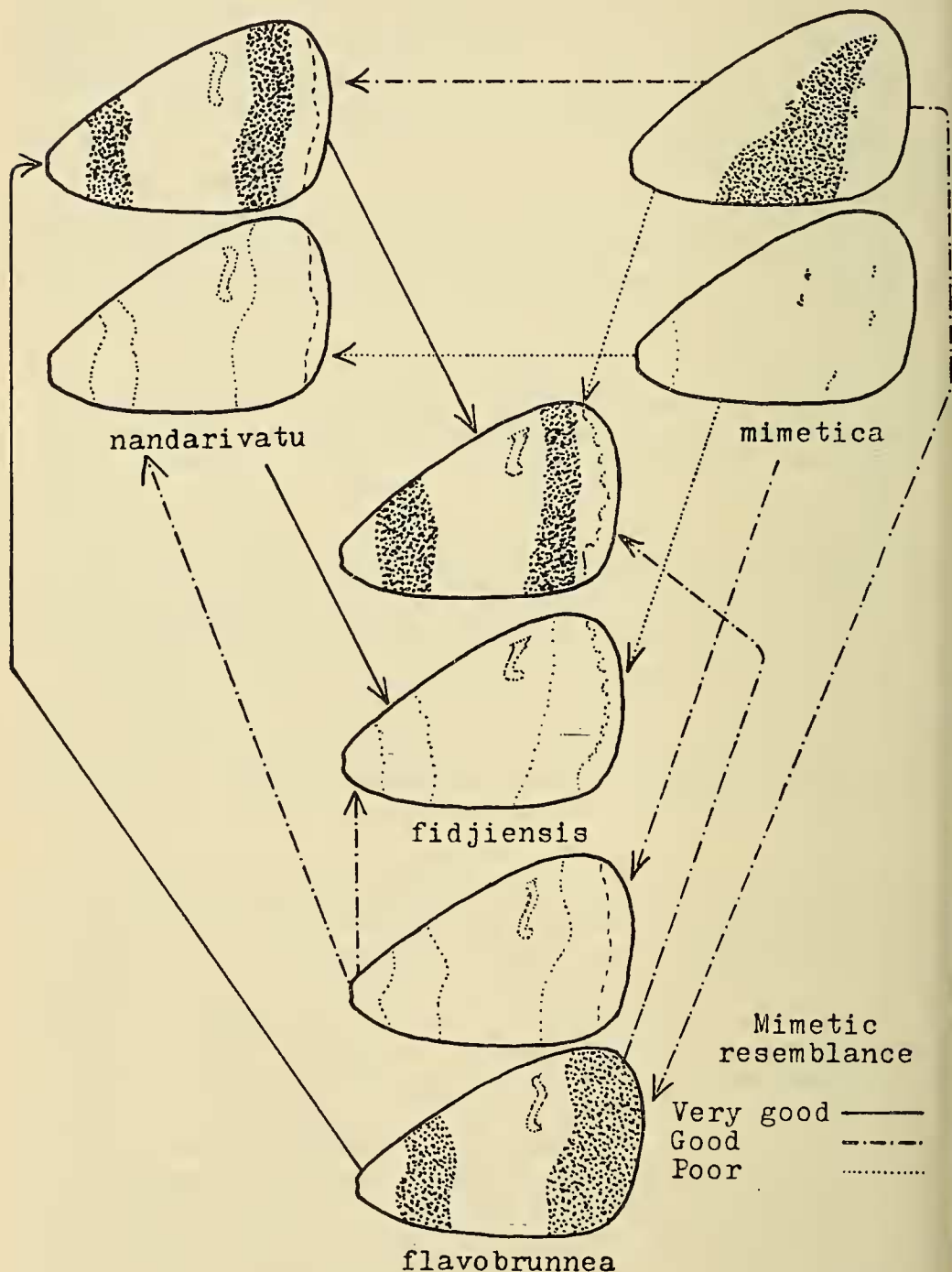


Figure I.

Until definite experiments show the pattern of predation of the morphs of each species, presumably involving the apparently rare insectivorous birds of the mimicry zone, I am in no position to claim this theory as any more than a hypothetical explanation of what may well prove to be a most intriguing problem.



In conclusion I would like to thank Dr. L. Davies and Mr J. Richardson of the Department of Zoology, University of Durham and Messrs A. H. Hayes and D. S. Fletcher of the British Museum (Natural History) for their generous help in the preparation of this paper.

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## West Midlands records of *Hydraecia*, *Procus* and *Oporinia* Species

By L. J. EVANS, F.R.E.S.

Since working on records for the Midland Plateau Survey, a project of the Birmingham Natural History Society (Recorder F. A. Noble), I have been making genitalia dissections for critical identification of the local melanic forms and other species difficult to identify. Recently my interest has been further stimulated by the Lepidoptera Distribution Maps Scheme organised by the Biological Records Centre at Monks Wood. On referring to back numbers of the 'Record' for information, I came across the *Hydraecia* and *Procus* records of R. F. Bretherton (1953) and A. Richardson (1951), and as I cannot find any published records for the West Midlands, I was prompted to write these few notes.

### HYDRAECIA SPECIES.

*H. oculea* L. Only appears sporadically at M.V. light in my garden in N.E. Birmingham, also at Sutton Park, Warwickshire, a semi-natural park which is about 2 to 3 miles further N.E. from Birmingham. Wyre Forest, one 8.viii.59.

*H. crinanensis* Burr. I have not found this species in the area as yet. My only specimen came with four *oculea* from another collection all labelled Harlech, N.W. 10.viii.52, C. Bantock.

*H. paludis* Tutt. Neither have I found this species in the area, but Noble (1964) records one specimen at light one mile west of the centre of Birmingham.

*H. lucens* Freyer. By far the commonest of the group in this area. Three or four at light in my garden which is bordered by a field of coarse grasses, is a good haul for one night. At Sutton Park, a heath and woodland area, it is only taken occasionally.

### PROCUS SPECIES.

With the exception of *Procus fasciuncula* Haw. which in North Birmingham shows little variation from the usual brownish-fawn colour (reddish-fawn in Sutton Park), the other four species of the genus occurring in this part of the Midlands are mainly melanic.

*P. strigilis* Clerk. Occurs commonly as the melanic form and frequently as the white-banded semi-melanic form over the greater part of the West Midlands. I have only taken the normal (brown) form at Randan Wood, Worcs., and Wyre Forest, Worcs. and Shrops.